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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

St. Louis, Missouri
March 17, 2003

CERTIFICATE OF MAILING

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Daniel S. Kasten
Attorney for Applicant(s)
Registration No.: 45,363

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OFFICE OF PETITIONS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Curtiss et al.	Group No.:	1645
Serial No.:	08/473,789	Atty. Docket No.:	53116-1780
Filed:	June 7, 1995		
For:	Recombinant Bacterial Vaccine System with Environmentally Limited Viability	Examiner:	Ginny Portner

Commissioner for Patents
Box DAC
Washington, DC 20231

RENEWED PETITION UNDER 37 C.F.R. §1.137(b)

Responsive to the official communication of March 5, 2003, paper no. 14,
Applicant submits this Renewed Petition Under 37 C.F.R. §1.137(b).

The petition under 37 C.F.R. §1.137(b) filed February 4, 2003 was dismissed because that petition did not include a terminal disclaimer. Included herewith is the required terminal disclaimer and fee, along with a copy of the previously filed petition. Applicant hereby requests reconsideration of the decision to dismiss that petition.

The Commissioner is hereby authorized to charge any additional fees which may be required or credit any overpayment to Deposit Account Number 20-0823. A duplicate copy of this sheet is enclosed.

Respectfully submitted,



Daniel S. Kasten, Reg. #45363
Thompson Coburn LLP
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**PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED
UNINTENTIONALLY UNDER 37 CFR 1.137(b))**

Docket Number (Optional)
53116-1780

First named inventor: Roy Curtiss III

Application No.: 08/473,789

Group Art Unit: 1645

Filed: 06/07/95

Examiner: Ginny Portner

Title: Recombinant Bacterial Vaccine System with Environmentally Limited Viability

Attention: Office of Petitions
Assistant Commissioner for Patents
Box DAC
Washington, D.C. 20231

FILE COPY

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:

- (1) Petition fee;
- (2) Reply and/or issue fee;
- (3) Terminal disclaimer with disclaimer fee --required for all utility and plant applications filed before June 8, 1995; and for all design applications; and
- (4) Statement that the entire delay was unintentional.

1. Petition fee

☒ Small entity-fee \$650 (37 CFR 1.17(m)). Applicant claims small entity status. See 37 CFR 1.27.

☐ Other than small entity - fee \$ (37 CFR 1.17(m))

2. Reply and/or fee

- A. The Commissioner is hereby authorized to charge fees in this application to a Deposit Account. I have enclosed a duplicate copy of this sheet.
- B. The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 20-0823. I have enclosed a duplicate copy of this sheet.

[Page 1 of 2]

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

3. Terminal disclaimer with disclaimer fee

- ☒ Since this utility/plant application was filed on or after June 8, 1995, no terminal disclaimer is required.
- ☐ A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of \$_____ for a small entity or \$_____ for other than a small entity) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

4. STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional. [NOTE: The United States Patent and Trademark Office may require additional information if there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137(b) was unintentional (MPEP 711.03(c)(III)(C) and (D))].

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2/4/03

Date

Daniel S. Kasten

Signature

Telephone

Number: 314-552-6000

Daniel S. Kasten

Typed or printed name

Thompson Coburn LLP

Address

Enclosures: ☒ Fee Payment Form

One US Bank Plaza, St. Louis, MO 63101-9928

- ☒ Reply
- ☐ Terminal Disclaimer Form
- ☐ Additional sheets containing statements establishing unintentional delay
- ☐ Other: _____

CERTIFICATE OF EXPRESS MAIL (37 CFR 1.10) OR TRANSMISSION (37 CFR 1.8(a))

I hereby certify that this correspondence is being:

- ☒ deposited with the United States Postal Service on the date shown below with sufficient postage as Express Mail in an envelope addressed to: Assistant Commissioner for Patents, Box DAC, Washington, D.C. 20231. Express Mail No. EL934232051US
- ☐ transmitted by facsimile on the date shown below to the United States Patent and Trademark Office at (703) 308-6916.

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Date

Daniel S. Kasten

Signature

Daniel S. Kasten

Typed or printed name of person signing certificate



NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Docket Number (Optional)
53116-1780

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on 02/04/03

Signature

Typed or printed name

Daniel S. Kasten

In re Application of
Curtiss et al.

Application Number
08/473,789

Filed
06/07/95

For
Recombinant Bacterial Vaccine System with Environmentally Limited Viability

Group Art Unit
1645

Examiner
Ginny Portner

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 1.17(b))

\$ 320.00.

☒ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is:

\$ 160.00.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☒ The Commissioner has already been authorized to charge fees in this application to a Deposit Account. I have enclosed a duplicate copy of this sheet.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 20-0823. I have enclosed a duplicate copy of this sheet.

☐ A petition for a 3 months extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☒ attorney or agent of record.

☐ attorney or agent acting under 37 CFR 1.34(a).
Registration number if acting under 37 CFR 1.34(a) _____

Signature

Daniel S. Kasten
Typed or printed name

02/04/03
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

St. Louis, Missouri
February 4, 2003

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as Express Mail (Express Mail No. EL934232051US) in an envelope addressed to: Assistant Commissioner for Patents, Box DAC, Washington, D.C. 20231 on February 4, 2003.

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In re application of:
Curtiss et. al.

Serial No.: 08/473,789

Filed: June 7, 1995

For: RECOMBINANT BACTERIAL
VACCINE SYSTEM WITH
ENVIRONMENTALLY LIMITED
VIABILITY

Examiner Ginny Portner

Group Art Unit 1645

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MAR 26 2003

OFFICE OF PETITIONS

Assistant Commissioner for Patents
Box DAC
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Thompson Coburn LLP

RESPONSE AND AMENDMENT

In response to the Office Action of September 27, 2001, paper no. 37, please enter and consider the following amendments and remarks in connection with the above-identified application.

IN THE CLAIMS:

The following claims have been amended as indicated:

Please cancel claims 4, 8, 9, 23, 35, and 41-43.

1. (Four times amended) An isolated microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable in a permissive environment and non-viable in a non-permissive environment, the system comprising
[(a)] an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said [the] essential gene is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment [, and wherein the essential gene is a copy of a wild-type gene of the microbial cell; and

(b) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment,

wherein the wild-type gene is inactivated in the cell] , and wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

27. (Four times amended) A method of making a cell strain with environmentally limited viability comprising stably introducing into a cell

[(a)] an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said [the] essential gene is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment, [and wherein the essential gene is a copy of a wild-type gene of the microbial cell;

(b) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment],

and wherein the cell strain is viable in a permissive environment and non-viable in a non-permissive environment [, wherein the wild-type gene is inactivated in the cell].

30. (Five times amended) A method of inducing immunoprotection in a warm-blooded animal comprising

administering to the animal [a vaccine comprising] a microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable when in the animal and non-viable when outside of the animal, the system comprising

[(a)] an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said [the] essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal [, and wherein the essential gene is a copy of a wild-type gene of the microbial cell; and

(b) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is outside of the animal but not when the cell is in the animal, wherein the wild-type gene is inactivated in the cell],

and wherein the cell is a member of the *Enterobacteriaceae*.

46. (New) The cell of claim 1 further comprising a lethal gene, wherein expression of the lethal gene is lethal to the cell and wherein the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment.

47. (New) The cell of claim 46 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

48. (New) The cell of claim 46 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of the *Enterobacteriaceae*.

49. (New) The cell of claim 46 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector.

50. (New) The cell of claim 49 wherein the vector has two lethal genes.

51. (New) The cell of claim 46 wherein expression of the essential gene is regulated by the expression product of a regulatory gene.

52. (New) The cell of claim 51 wherein the expression product of the regulatory gene inhibits expression of the essential gene and said expression product is expressed or active only in the non-permissive environment.

53. (New) The cell of claim 49 wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed in the permissive environment and is not expressed in the non-permissive environment.

54. (New) The cell of claim 46 further comprising an expression gene wherein the expression gene encodes a desired expression product.

55. (New) The cell of claim 46 [for use as a vaccine], wherein the cell is viable when in an animal and non-viable when outside of the animal, the essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, and the lethal gene is expressed when the cell is outside of the animal and is not expressed when the cell is in the animal, wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C, wherein the cell is a member of *Enterobacteriaceae*.

56. (New) The cell of claim 55 further comprising an expression gene wherein the expression gene encodes a desired expression product.

57. (New) The method of claim 27 further comprising stably introducing into a cell a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment.

58. (New) The method of claim 57 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

59. (New) The method of claim 57 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of *Enterobacteriaceae*.

60. (New) The method of claim 30, wherein said microbial cell further comprises [further comprising] a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is outside of the animal but not when the cell is in the animal.

61. (New) The method of claim 60 wherein the system further [comprising] comprises an expression gene wherein the expression gene encodes an antigen.

62. (New) The method of claim 61 wherein the antigen is selected from the group consisting of bacterial antigens, viral antigens, plant antigens, fungal antigens, insect antigens, and non-insect animal antigens.

63. (New) The method of claim 60 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector, and wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, wherein the cell is a member of the *Enterobacteriaceae*.

64. (New) The cell of claim 51 wherein the absence of a functional expression product of the regulatory gene derepresses expression of the essential gene and wherein the expression product is not expressed or is inactive only in the permissive environment.

65. (New) The method of claim 46 wherein the essential gene is an *asd* gene, a *dap* gene, a *dal* gene, a *ddl* gene, a *fab* gene, or a *pls* gene.

66. (New) An isolated microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable in a permissive environment and non-viable in a non-permissive environment, the system comprising

(a) an essential gene, wherein expression of the gene in the cell is essential to the viability of the cell, wherein said essential gene is native to the cell, and wherein said essential gene is inactivated in the cell;

(b) a copy of said essential gene, wherein said copy is introduced into the cell, and wherein said copy is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment; and

(c) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment,

wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

67. (New) The cell of claim 66 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

68. (New) The cell of claim 66 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of the *Enterobacteriaceae*.

69. (New) The cell of claim 66 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector.

70. (New) The cell of claim 69 wherein the vector has two lethal genes.

71. (New) The cell of claim 66 wherein expression of the essential gene is regulated by the expression product of a regulatory gene.

72. (New) The cell of claim 71 wherein the expression product of the regulatory gene inhibits expression of the essential gene and wherein said expression product is expressed or active only in the non-permissive environment.

73. (New) The cell of claim 69 wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed in the permissive environment and is not expressed in the non-permissive environment.

74. (New) The cell of claim 66 further comprising an expression gene wherein the expression gene encodes a desired expression product.

75. (New) The cell of claim 66 [for use as a vaccine], wherein the cell is viable when in an animal and non-viable when outside of the animal, the essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, and the lethal gene is expressed when the cell is outside of the animal and is not expressed when the cell is in the animal, wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C, wherein the cell is a member of *Enterobacteriaceae*.

76. (New) The cell of claim 75 further comprising an expression gene wherein the expression gene encodes a desired expression product.

77. (New) A method of making a cell strain with environmentally limited viability comprising

(a) inactivating an essential gene in a cell, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said essential gene is native to the cell; and

(b) stably introducing into the cell

(i) a copy of said essential gene, wherein said copy is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment; and

(ii) a lethal gene, wherein expression of the lethal gene is lethal to the cell and wherein the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment,

wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

78. (New) The method of claim 77 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

79. (New) The method of claim 77 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of *Enterobacteriaceae*.

80. (New) A method of inducing immunoprotection in a warm-blooded animal comprising

administering to the animal [a vaccine comprising] a microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable when in the animal and non-viable when outside of the animal, the system comprising

(a) an essential gene, wherein expression of the gene in the cell is essential to the viability of the cell, wherein said essential gene is native to the cell, and wherein said essential gene is inactivated in the cell;

(b) a copy of said essential gene, wherein said copy is introduced into the cell, and wherein said copy is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal; and

(c) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is outside of the animal but not when the cell is in the animal, wherein the cell is a member of the *Enterobacteriaceae*.

81. (New) The method of claim 80 wherein the system further [comprising] comprises an expression gene wherein the expression gene encodes an antigen.

82. (New) The method of claim 81 wherein the antigen is selected from the group consisting of bacterial antigens, viral antigens, plant antigens, fungal antigens, insect antigens, and non-insect animal antigens.

83. (New) The method of claim 80 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector, and wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, wherein the cell is a member of the *Enterobacteriaceae*.

84. (New) The cell of claim 51 wherein the absence of a functional expression product of the regulatory gene derepresses expression of the essential gene and wherein the expression product is not expressed or is inactive only in the permissive environment.

85. (New) The method of claim 66 wherein the essential gene is an *asd* gene, a *dap* gene, a *dal* gene, a *ddl* gene, a *fab* gene, or a *pls* gene.

REMARKS

Claims 1-4, 8-14, 16, 20, 23-24, 27-32, 35, 37 and 41-44 are pending in the present application. Claims 1, 27, and 30 have been amended to no longer recite a lethal gene or

the phrase "the wild-type gene is inactivated in the cell". Support can be found on p. 9 lines 8-12 and 17-19 of the specification, which describes the Environmentally Limited Viability System ("ELVS") as combining specific regulation with essential gene *and/or* lethal genes to limit the viability of a microorganism to a permissive environment. Thus, limited viability of a microorganism to an environment can be achieved by simply regulating the essential gene with or without the lethal gene. New claims 66-85 have been added to clarify that, in these particular embodiments, the essential gene native to the host cell can be inactivated, and the claimed invention can still operate as intended because an active copy of said essential gene is expressed in a permissive environment and not expressed in a non-permissive environment. Support can be found in the specification, for example, on p. 6, lines 5 - 11, Figure 4, and on p. 46, lines 10-22, to p. 50 lines 24.

REJECTION UNDER NON-STATUTORY DOCTRINE OF OBVIOUSNESS-TYPE DOUBLE PATENTING

Claims 1-4, 8-14, 16, 20, 23-24, 27-32, 35, 37 and 41-44 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting over U.S. Patent Application Ser. No. 08/761,769. As there are no allowable claims in the instant application at this time, Applicants wish to defer responding to this rejection until such time as there are allowable claims.

REJECTION UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claims 1-4, 8-14, 16, 20, 23-24, 27-29, 30-32, 37 and 41-44 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The Office alleges that the phrase "wild type gene is inactivated in the cell" render the essential gene inactivated by any means and at any time, such that the essential gene could not be expressed even in a permissive environment.

Applicants respectfully submit that the phrase "wild type gene is inactivated in the cell" has been deleted from claims 1, 27, 30 and is not recited in new claims 46-65. However, as recited in new claims 66 - 85, the essential gene can be inactivated, and the claimed invention can still operate as intended. That is, the essential gene is expressed in the permissive environment and is not expressed in the non-permissive environment. In that embodiment, an essential gene native to the host cell is inactivated and thus, not expressed in any environment.

Inactivation can be achieved by any means known by those skilled in the art or taught in the specification. For example, the specification (p. 30, lines 13-16) teaches a deletion of the *asd* gene to inactivate it. Alternatively, a skilled artisan can use site-directed mutagenesis to inactivate the essential gene. An active *copy* of said essential gene is introduced into said host cell, and that copy of the essential gene is expressed in a permissive environment, but not expressed in a non-permissive environment.

In short, the Environmentally Limited Viability System in the claimed microbial cell comprises at least an essential gene that is specifically regulated to turn on and off in the permissive and non-permissive environments, respectively. In another embodiment, the system further comprises at least one lethal gene which is expressed in a non-permissive environment and not expressed in the permissive environment. Cell death in a non-permissive environment, therefore, can be achieved by the expression of a lethal gene and the nonexpression of the essential gene. In still a further embodiment, an essential gene, native to the host cell, is inactivated and an active copy of said essential gene is introduced into the host cell and is expressed in the permissive environment and not expressed in a non-permissive environment. In essence, each embodiment requires the regulation of an essential gene in the permissive and non-permissive environments.

Applicants, therefore, submit that the claims, as amended and introduced, are clear and not indefinite and respectfully request the Office withdraw its rejection under 35 U.S.C. § 112, second paragraph.

REJECTION UNDER 35 U.S.C. § 112, FIRST PARAGRAPH

Claims 1-4, 8-14, 16, 20, 23-24, 27-29, 30-32, 37 and 41-44 stand rejected under 35 U.S.C. § 112, first paragraph, for lack of enablement. Specifically, the Office alleges that all of the claims recite dead cells because the essential gene is inactivated under any conditions, permissive or nonpermissive.

Applicants respectfully submit that the amended claims 1, 27, and 30 and new claims 46-65 do not recite dead cells as they do recite expression of an essential gene for viability. First, the claims no longer recite "wherein the wild type gene is inactivated in the cell". Second, as discussed above, if an essential gene native to the host cell is inactivated, as in claims 66-85, then an active copy of said essential gene is introduced into said cell, allowing said

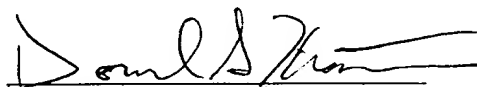
active copy of the essential gene to be expressed in a permissive environment, but not expressed in a nonpermissive environment.

Applicants respectfully request reconsideration and withdrawal of the Office's rejection under 35 U.S.C. § 112, first paragraph.

CONCLUSION

In light of the above amendments and remarks, Applicants believe all of the Office's rejections have been overcome or obviated and that the claims are in form for allowance, and respectfully request that such allowance be granted.

Respectfully submitted,



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February 4, 2003

AMENDED AND ADDED CLAIMS

1. (Four times amended) An isolated microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable in a permissive environment and non-viable in a non-permissive environment, the system comprising an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said essential gene is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment, and wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

27. (Four times amended) A method of making a cell strain with environmentally limited viability comprising stably introducing into a cell an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said essential gene is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment, and wherein the cell strain is viable in a permissive environment and non-viable in a non-permissive environment.

30. (Five times amended) A method of inducing immunoprotection in a warm-blooded animal comprising administering to the animal a microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable when in the animal and non-viable when outside of the animal, the system comprising an essential gene, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said [the] essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, and wherein the cell is a member of the *Enterobacteriaceae*.

46. (New) The cell of claim 1 further comprising a lethal gene, wherein expression of the lethal gene is lethal to the cell and wherein the lethal gene is expressed when

the cell is in the non-permissive environment but not when the cell is in the permissive environment.

47. (New) The cell of claim 46 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

48. (New) The cell of claim 46 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of the *Enterobacteriaceae*.

49. (New) The cell of claim 46 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector.

50. (New) The cell of claim 49 wherein the vector has two lethal genes.

51. (New) The cell of claim 46 wherein expression of the essential gene is regulated by the expression product of a regulatory gene.

52. (New) The cell of claim 51 wherein the expression product of the regulatory gene inhibits expression of the essential gene and said expression product is expressed or active only in the non-permissive environment.

53. (New) The cell of claim 49 wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed in the permissive environment and is not expressed in the non-permissive environment.

54. (New) The cell of claim 46 further comprising an expression gene wherein the expression gene encodes a desired expression product.

55. (New) The cell of claim 46 [for use as a vaccine], wherein the cell is viable when in an animal and non-viable when outside of the animal, the essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, and the lethal gene is expressed when the cell is outside of the animal and is not expressed when the cell is in the animal, wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C, wherein the cell is a member of *Enterobacteriaceae*.

56. (New) The cell of claim 55 further comprising an expression gene wherein the expression gene encodes a desired expression product.

57. (New) The method of claim 27 further comprising stably introducing into a cell a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment.

58. (New) The method of claim 57 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

59. (New) The method of claim 57 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of *Enterobacteriaceae*.

60. (New) The method of claim 30, wherein said microbial cell further comprises [further comprising] a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is outside of the animal but not when the cell is in the animal.

61. (New) The method of claim 60 wherein the system further [comprising] comprises an expression gene wherein the expression gene encodes an antigen.

62. (New) The method of claim 61 wherein the antigen is selected from the group consisting of bacterial antigens, viral antigens, plant antigens, fungal antigens, insect antigens, and non-insect animal antigens.

63. (New) The method of claim 60 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector, and wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal,
wherein the cell is a member of the *Enterobacteriaceae*.

64. (New) The cell of claim 51 wherein the absence of a functional expression product of the regulatory gene derepresses expression of the essential gene and wherein the expression product is not expressed or is inactive only in the permissive environment.

65. (New) The method of claim 46 wherein the essential gene is an *asd* gene, a *dap* gene, a *dal* gene, a *ddl* gene, a *fab* gene, or a *pls* gene.

66. (New) An isolated microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable in a permissive environment and non-viable in a non-permissive environment, the system comprising

(a) an essential gene, wherein expression of the gene in the cell is essential to the viability of the cell, wherein said essential gene is native to the cell, and wherein said essential gene is inactivated in the cell;

(b) a copy of said essential gene, wherein said copy is introduced into the cell, and wherein said copy is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment; and

(c) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment,

wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

67. (New) The cell of claim 66 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

68. (New) The cell of claim 66 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of the *Enterobacteriaceae*.

69. (New) The cell of claim 66 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector.

70. (New) The cell of claim 69 wherein the vector has two lethal genes.

71. (New) The cell of claim 66 wherein expression of the essential gene is regulated by the expression product of a regulatory gene.

72. (New) The cell of claim 71 wherein the expression product of the regulatory gene inhibits expression of the essential gene and wherein said expression product is expressed or active only in the non-permissive environment.

73. (New) The cell of claim 69 wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed in the permissive environment and is not expressed in the non-permissive environment.

74. (New) The cell of claim 66 further comprising an expression gene wherein the expression gene encodes a desired expression product.

75. (New) The cell of claim 66 [for use as a vaccine], wherein the cell is viable when in an animal and non-viable when outside of the animal, the essential gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal, and the lethal gene is expressed when the cell is outside of the animal and is not expressed when the cell is in the animal, wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C, wherein the cell is a member of *Enterobacteriaceae*.

76. (New) The cell of claim 75 further comprising an expression gene wherein the expression gene encodes a desired expression product.

77. (New) A method of making a cell strain with environmentally limited viability comprising

(a) inactivating an essential gene in a cell, wherein expression of the essential gene in the cell is essential to the viability of the cell, and wherein said essential gene is native to the cell; and

(b) stably introducing into the cell

(i) a copy of said essential gene, wherein said copy is expressed when the cell is in the permissive environment and is not expressed when the cell is in the non-permissive environment; and

(ii) a lethal gene, wherein expression of the lethal gene is lethal to the cell and wherein the lethal gene is expressed when the cell is in the non-permissive environment but not when the cell is in the permissive environment,

wherein the essential gene is essential for metabolism, growth, cell wall integrity, or cell membrane integrity of the cell.

78. (New) The method of claim 77 wherein the permissive environment comprises a temperature of about 37°C and the non-permissive environment comprises a temperature of less than about 30°C.

79. (New) The method of claim 77 wherein the permissive environment is inside a warm-blooded animal and the non-permissive environment is outside a warm-blooded animal, wherein the cell is a member of *Enterobacteriaceae*.

80. (New) A method of inducing immunoprotection in a warm-blooded animal comprising

administering to the animal [a vaccine comprising] a microbial cell comprising an Environmentally Limited Viability System, wherein the cell is viable when in the animal and non-viable when outside of the animal, the system comprising

(a) an essential gene, wherein expression of the gene in the cell is essential to the viability of the cell, wherein said essential gene is native to the cell, and wherein said essential gene is inactivated in the cell;

(b) a copy of said essential gene, wherein said copy is introduced into the cell, and wherein said copy is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal; and

(c) a lethal gene, wherein expression of the gene is lethal to the cell and the lethal gene is expressed when the cell is outside of the animal but not when the cell is in the animal, wherein the cell is a member of the *Enterobacteriaceae*.

81. (New) The method of claim 80 wherein the system further [comprising] comprises an expression gene wherein the expression gene encodes an antigen.

82. (New) The method of claim 81 wherein the antigen is selected from the group consisting of bacterial antigens, viral antigens, plant antigens, fungal antigens, insect antigens, and non-insect animal antigens.

83. (New) The method of claim 80 wherein the essential gene, the lethal gene, or both, is carried on an extrachromosomal vector, and wherein the system further comprises a replication gene carried on a chromosome of the cell, the expression of which is required for replication of the vector, wherein the replication gene is expressed when the cell is in the animal and is not expressed when the cell is outside of the animal,

wherein the cell is a member of the *Enterobacteriaceae*.

84. (New) The cell of claim 51 wherein the absence of a functional expression product of the regulatory gene derepresses expression of the essential gene and wherein the expression product is not expressed or is inactive only in the permissive environment.

85. (New) The method of claim 66 wherein the essential gene is an *asd* gene, a *dap* gene, a *dal* gene, a *ddl* gene, a *fab* gene, or a *pls* gene.